

A POPULATION ESTIMATE OF THE DUSKY SEASIDE SPARROW

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DURING the spring of 1968 I attempted to determine the absolute numbers and distribution of the Dusky Seaside Sparrow (*Ammospiza nigrescens*), which has been regarded as threatened with extinction (Bureau of Sport Fisheries and Wildlife, 1966). Most of the few completed world population censuses of birds fall into four general types: those concerning (1) large and conspicuous species, often water birds, and often lending themselves to aerial census and photographic techniques, such as the North Pacific albatrosses (Rice and Kenyon, 1962); (2) populations that gather into few traditional breeding or wintering concentrations, such as the Gannet (Fisher and Vevers, 1944); (3) conspicuous endangered species, of at least seasonally restricted distribution, such as the California Condor (Miller, McMillan and McMillan, 1965); and (4) less conspicuous species of a very restricted distribution, often on islands, like the Takahe (Williams, 1952). The Dusky Seaside Sparrow, confined to the salt marshes of Brevard County, Florida, falls into this last category. For a review of the early literature on total-bird-population censuses, see Fisher (1954).

HISTORY

Ammospiza nigrescens was discovered in 1872 around Salt Lake on the Florida mainland (Fig. 1) (Maynard, 1875), where it was presumably always rare (Chapman, 1899). Certainly it has not been seen there since (Baynard, 1914; Charles H. Trost, in litt.). Maynard found the species abundant on the salt marshes of the northern half of Merritt Island, and Chapman (1899, 1912) reported it there from Banana Creek to the mouth of Dummitt Creek (see also Baynard, 1914; Vars, 1926). Charles E. Carter, a friend of the late D. J. Nicholson, told me that it was not uncommon for the latter to find 30 Dusky nests in a day's egg-collecting in just that part of the salt marsh across the bridge from Titusville. In addition, Nicholson (1929) reported a colony of 20 pairs on the mainland, 1½ miles east of the St. John's River, due west of Indian River City. Since 1957, the Merritt Island salt marsh has been impounded for mosquito control (for vegetation changes, see Provost, 1959; Trost, 1968) with the result that by 1961-63 the Dusky Seaside Sparrow population had been reduced to (a minimum of) four aggregations totaling approximately 70 pairs (Trost, in litt.). Trost also found that the colony on the mainland had dwindled by 1962 to about five pairs, and subsequently these birds disappeared entirely (Bureau of Sport Fisheries and Wildlife, 1966:B-49). *A. nigrescens* is



FIG. 1. Present and former distribution of the Dusky Seaside Sparrow, Brevard County, Florida.

at the moment on the rare and endangered species list of the U. S. Fish and Wildlife Service (*ibid.*). It was because of this critical situation that the present study was undertaken.

METHOD

The census method was the singing-male count, which is most efficient for inconspicuous small birds in dense cover, where flushing distances are short and the habitat extensive. However, the method has two major disadvantages: it is less than 100 per cent efficient, and variably so. When one visits a given nesting area, only a certain proportion of the total males present will be singing, depending upon the stage of the breeding eyele, time of day, climate, and weather. This proportion, designated *effectivity* by European ornithologists (Enemar, 1959; Williamson, 1964) is a refinement of Colquhoun's (1940) "coefficient of conspicuousness" (see also Palmgren, 1930; Hickey, 1943:83; Nee, 1943:122-

4). Effectivity is determined by repeatedly visiting, at different times of the day, a number of colonies (whose total male population becomes known in the process) and by mapping the males recorded. The percentage of males recorded singing on any one visit is the effectivity, or efficiency of the census (hereafter designated "Ef"). To increase sample size Ef data were on a few occasions gathered from study areas censused only twice, and the population was taken to be the number seen on the highest count, the lower count being compared to this for the purpose of effectivity. If the summation method of Palmgren (1930:93) is used in conjunction with the mapping method, the higher of the census figures can also be used for Ef, this being compared to the non-overlapping composite of the two or more counts. Ef tends to be overestimated if the area has not been censused at least three or four times and the locations of singing males mapped.

Most of the area was covered on foot, part on horseback, and part by bicycle. A helicopter was used to determine the simple presence or absence of the Dusky Seaside Sparrow in some of those areas not covered from the ground due to lack of time. If one flies at 100 ft at 30 mph over the marshes, all species of birds flushed, including passerines, can be identified from prior field experience on the ground. The Dusky Seaside Sparrow is distinctive, especially in flight, and could be carelessly confused only with the female Red-winged Blackbird (*Agelaius phoeniceus*).

THE AREA

For a description of typical salt marsh habitat on Merritt Island, see Nicholson (1928:229) and Trost (1968:851). The Dusky Seaside Sparrow uses the restricted zone where the short grass *Distichlis spicata* and the tall *Spartina bakeri* interdigitate, producing a heterogeneous pattern. For a botanical treatment of the St. John's marshes, including a point-quadrat analysis, see Sincock (1958). The marshes on the mainland between Routes 520 and 46 are dominated by salt-marsh plants, primarily *Spartina bakeri*, and dotted with palm trees (*Sabal palmetto*) and hammocks, so that the total aspect is savannah-like. Water levels and salinities vary considerably with the precipitation pattern, with a corresponding variability in the height and density of the *Spartina*, thus providing diversity of bird niches within the same tall-grass life form. Because salinities are low at times of high water, a number of freshwater marsh plants add variety to the vegetation but are never dominant. The mainland salt marsh owes its existence to Pleistocene interglacial invasion by marine waters below the 20-ft contour line, when salt was deposited in the sediments (Odum, 1953). Usually much of the St. John's is inaccessible, but 1968, the second year of a general Florida drought, was opportune for the purposes of census.

RESULTS AND DISCUSSION

Figure 2 shows the bimodal effectivity curve as a function of the time of day, the peaks occurring in the early morning and evening. The discrepant Ef (86 per cent) for the hour of 12:00–12:59, based on one observation period during and after a light rain, was due to the vigorous resumption of singing characteristic of the species under such conditions (Trost, 1968:852). The maximum average Ef figure of 73 per cent for the early morning agrees surprisingly well with Enemar's effectivities for the Willow Warbler (*Phylloscopus trochilus*) (73 per cent), Garden Warbler (*Sylvia borin*) (73 per cent), Ortolan Bunting (*Emberiza hortulana*) (65 per cent), etc. (Enemar, 1959:32).

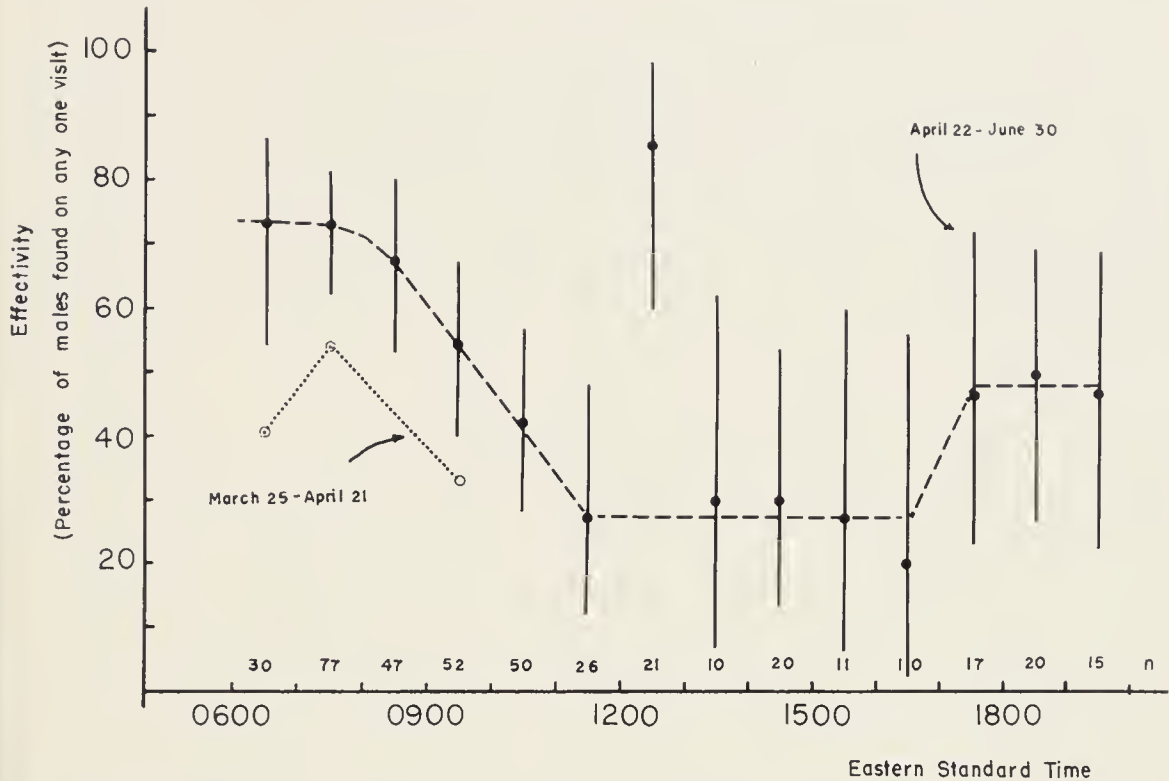


FIG. 2. Efficiency of the census (effectivity) expressed as a function of the time of day. Vertical lines through the means are confidence limits (95 per cent), n is sample size for the line of 22 April-30 June. Curve is drawn in visually.

but is less than the 88 per cent for the American Woodcock (*Philohela minor*) (Duke, 1966; Sharp, unpubl.), whose activities are concentrated into a short crepuscular period. In contrast to the present study, Enemar (1959:27) found that effectivities were almost constant throughout the day, this perhaps being a reflection of the more uniform Swedish woodland climate. This and the fact that a shower can stimulate singing in the middle of the day imply that the pattern of singing activity is not part of a circadian rhythm, but is a function of microclimatic conditions, specifically, in an exposed salt marsh, either of the oppressiveness of the heat or of light intensity. Ricklefs and Hainsworth (1968) report on the temperature-dependent behavior of the Cactus Wren (*Campylorhynchus brunneicapillus*), which selects cooler microhabitats increasingly toward early afternoon, unless cloud cover allows the birds to frequent more exposed areas. One of the reasons that the effectivities for *nigrescens* are as high as they are in the middle of the day (27 per cent) is the effect of either the bird detecting the observer or being flushed by the observer walking through the grass, after which males had a tendency to sing briefly, stimulating their neighbors to do the same. Spontaneous sporadic outbursts of territorial behavior also occur (Nicholson, 1928:228), interrupting the general midday silence and raising the average Ef.

Due to an atypical coolness of the spring, effectivities were lower, although not significantly so, during the first four weeks of the singing period than during the second and third four-week periods, between which there was no difference. By summer, singing intensity is reported to diminish markedly (cf. Davis, 1965). There was no difference between the effectivities of the Merritt Island and the St. John's birds, even though densities were significantly different (6.7 ± 0.6 and, in the best areas, 3.0 ± 0.3 acres/bird, respectively, $P = 0.05$).

THE CENSUS

Merritt Island National Wildlife Refuge.—On Merritt Island, traditional haunt of *nigrescens* and mecca for birdfinders (Pettingill, 1951:85), six weeks of repeated searching and territorial mapping revealed a remnant population of 33–34 males, all but 4 or 5 of which were located in breeding aggregations of 7, 8, and 14 birds. This represents a decrease of at least 50 per cent over the past 5 years. In 1968 these 29 males occupied 200 acres of remaining suitable salt-marsh vegetation at the above-mentioned comparatively low density. Another two males, apparently unmated, were attempting to subsist on small territories of 1.1 and 0.8 acres, and at least two wandering males did not have permanent territories at all. Of 7,565 acres of impounded salt marsh only about 6,000 were originally suitable habitat for the Dusky Seaside Sparrow if one assumes that the birds had to be within a certain distance (2,300 ft) of the tidal zone either for feeding (Tomkins, 1941; Trost, 1968:852) or for reasons of habitat selection (the grass *Distichlis* occupies a lower place in the salt-marsh plant zonation: Chapman, 1960:256–9). If one assumes also that their former density was similar to that now found on the St. John's River (perhaps an underestimate, cf. Trost, 1968:852) and that all suitable habitat was filled, an estimate of the former population on Merritt Island is of the order of 2,000 pairs. This seems not unreasonable in view of the above testimony to the former abundance of the bird.

St. John's River.—In May and June, 372 singing males, many of which were paired, were found on the St. John's River marshes in breeding aggregations of various sizes, 95 in the largest. In Table 1 the number of birds found at any particular time of day is divided by the corresponding known Ef figure to arrive at a more realistic population estimate. For convenience, some of the not significantly differing Ef values of Figure 1 have been lumped, and 14 birds found by revisiting colonies were excluded as these were accounted for by means of Ef. Thus 358 males found actually represent about 641 males in the area searched. Of these 358, all but 33 were found between the 10- and 15-ft contour lines of the USGS quadrangles, and none above 17–18 ft. Above this elevation the marsh is often dry enough for invasion by *Sabal palmetto*

TABLE 1
THE NUMBER OF MALES FOUND IN THE ST. JOHN'S RIVER MARSHES AT VARIOUS HOURS
OF THE DAY CORRECTED FOR EFFECTIVITY

Eastern Standard Time	No. of males found	Effectivity		Corrected no. of males		
		Mean	95 per cent limits	Mean	95 per cent	
					Lower	Upper
06:00-08:59	217	0.71	0.63-0.78	305.6	278.2	344.4
09:00-09:59	40	0.54	0.40-0.68	74.1	58.8	100.0
10:00-10:59	29	0.42	0.28-0.57	69.0	50.9	103.5
11:00-16:59	31	0.27	0.18-0.38	114.8	81.6	172.2
	9	0.86	0.60-0.98	10.5	9.2	15.0
17:00-19:59	32	0.48	0.34-0.62	66.7	51.6	94.1
	358			640.7	530.3	829.2

and is susceptible to burning, while below 10 ft the flooding of the river probably sets a lower limit to colonization. Ninety-five per cent of the Dusky Seaside Sparrow nests ($n = 39$) are located between 10 and 13 inches above the ground, but two weeks after the near hurricane of 3-5 June which deposited 14 inches of water, there were still 2 ft of water below the 10-ft contour, whereas a number of other revisited colonies were for the most part on dry ground. The day after the hurricane, water depth in one colony was 5-7 inches. On Merritt Island, where the effect of the tides (except wind tides) is negligible, the seaside sparrow has evidently lost the habit of nesting higher. In comparison, the New Smyrna Seaside Sparrow (*A. maritima pelonota*), with a former colony located at the mouth of a tidal inlet, builds a nest whose average height above the ground was 19-26 inches (95 per cent limits, $n = 24$). (These and the above nest data were taken from the slips for the egg collections of the late Charles E. Carter, Orlando, and Clemson University, Clemson, South Carolina.) The river is used by cattle for drinking water in the dry season; consequently, areas below 10 ft tend to be heavily grazed.

Using a planimeter, large-scale (1 in. = 400 ft.) aerial photographs (flown 1967), and USGS quadrangles for reference to contour lines, I measured the areas searched, left unsearched, less than 10 ft, 10-15 ft, and above 15 ft (Table 2). The 641 males occupied an area of 2,980 acres, with an overall density of 4.65 acres/male. Of the unsearched habitat which appeared suitable from the aerial photographs, most of which lay between 10 and 15 ft, and in one area of which a Dusky Seaside Sparrow was flushed by the helicopter, there are possibly another 629 males. This, however, represents a maximum number because field investigation will prove some of this area unsuitable. Much

TABLE 2
ESTIMATE OF THE DUSKY SEASIDE SPARROW POPULATION IN THE ST. JOHN'S MARSHES,
SPRING, 1968

Habitat	Acres	Corrected no. of males		No. of acres per male	
		Mean	95 per cent limits	Mean	95 per cent limits
Searched					
No. present	2983 ¹	641	530-829	4.65	3.60-5.63
No. absent	5941 ²				
Unsearched					
Good: 10-15 ft, ungrazed, unburned	976 ³	210	173-271	4.65	3.60-5.63 ⁴
Poor: 10-15 ft, grazed or burned	287 ³	43	39-47	6.7	6.1-7.3 ⁵
Unlikely: <10 ft, or >15 ft	843	—	—	—	—
Total		894	742-1147		

¹ Almost all 10-15 ft above sea level.

² 513 acres <10 ft, 4433 acres 10-15 ft, and 995 acres >15 ft.

³ 40.2 per cent of the actual acreage, based on the fact that 59.8 per cent of searched habitat between 10 and 15 ft was either unsuitable or unfilled.

⁴ Assumed to be the same as the density in searched habitat.

⁵ The density of the Merritt Island population.

of the St. John's is grazed by Brahma cattle and burned by ranchers to provide higher-quality forage. By the second or third year after burning, the grass is high enough again to be utilized by the Dusky Seaside Sparrow, but it is impossible to say with certainty from aerial photographs alone what conditions will be actually encountered. A second reason for habitat proving unsuitable is the fact that the Dusky occupies a middle position along a moisture gradient where the density of the *Spartina* is 1741 ± 24 stems/m² and the height 3.05 ± 1.29 ft ($P = 0.05$). Numerous references in the literature testify that the habitat of the Dusky Seaside Sparrow is somewhat drier than most salt marshes, and on the St. John's this preference is evident from the bird's distribution. The bird is usually absent from wetter low places where the *Spartina* is more dense; and in the driest areas where the *Spartina* is shorter and thinner, *nigrescens* is replaced by the Eastern Meadowlark (*Sturnella magna*). Further, the breeding distribution of *nigrescens* tends to be aggregated due to social tendency (cf. Tomkins, 1941 for *A. m. macgillivraii*). For these reasons, I found that about 60 per cent (4,434 acres) of the *Spartina* marsh was either unsuitable or unfilled, which proportion probably applies to unsearched habitat. Therefore, the possible 629 additional males should be reduced to a probable 253 (95 per cent limits 213-318). The total number of male *nigrescens*

on the St. John's, actual and probable, is about 894 (95 per cent limits 742-1147).

SUMMARY

A singing-male census of the endangered Dusky Seaside Sparrow, conducted in the spring of 1968, revealed a remnant population of 33-34 males on Merritt Island and a heretofore unknown population of 372 males in the St. John's River marshes between Routes 520 and 46 on the east side of the river. Efficiency of the census varied from 73 per cent (95 per cent confidence limits 63-82 per cent) from 06:00-08:00, dropping gradually throughout the morning to a low of 27 per cent (18-38 per cent) from 11:00 to 17:00, and rising again in the evening to 48 per cent (34-62 per cent). Therefore, the St. John's figure of 372 actually represents about 641 males (95 per cent limits 530-829). An additional 253 males probably exist in unsearched habitat.

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